

Temperature: "energy" as a reactant or a product.



$[A] \uparrow$  eq. shifts to right

$T^\circ \uparrow$  means  $[\text{energy}] \uparrow$  eq shifts to right



stress:  $T^\circ$  decreases

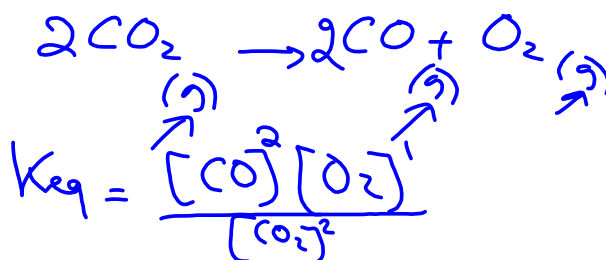


$T^\circ \downarrow$  means  $[\text{energy}] \downarrow$   
 $[\text{Product}] \downarrow$

according to Le Chatelier, system will oppose the change by making more products  $\therefore$  shifts to the right.

(mol/L)	$A + B \rightleftharpoons C$		
I	✓	✓	0
C			
<u>E</u>		?	

$K_{eq} = \checkmark$   
 or  
 $[ ]_{eq} = \checkmark$



Calculations:

Sample 1)  $K_{eq} = \frac{(0.35)^2 (0.15)}{(1.2)^2}$   
 $= 0.01276$   
 $K_{eq} = 0.013$

$K_p = \frac{P_{H_2S}^2}{P_{S_2} \cdot P_{H_2}^2}$  } Given at eq  
 $= \frac{(1.68)^2}{(1.37)(0.88)^2}$   
 $= 2.7$

mol/L

	$I_2$ (M)	$Cl_2$ (M)	$2ICl$ (M)
I	0.83	0.083	0.083
C	-1x	-1x	+2x
E	0.083 - x	0.083 - x	2x

$K_{eq} = \frac{[ICl]^2}{[I_2][Cl_2]} = \frac{(2x)^2}{(0.083-x)(0.083-x)}$   
 $82 = \frac{(2x)^2}{(0.083-x)^2}$   
 $\sqrt{82} = \frac{2x}{0.083-x}$   
 $9.06 \approx \frac{2x}{0.083-x}$   
 $(9.06)(0.083-x) = 2x$   
 $0.752 - 9.06x = 2x$   
 $0.752 = 2x + 9.06x$   
 $\frac{0.752}{11.06} = \frac{11.06x}{11.06}$   
 $x = 0.068 \text{ mol/L}$

Go back to equilibrium concentrations:  
 $[H_2] = [I_2] = 0.083 - x = 0.015 \text{ mol/L}$   
 $[HI] = 2x = 0.136 = 0.14 \text{ mol/L}$

0.13 mol  $K_{eq} = \checkmark$  easy

$SO_2 + NO_2 \rightleftharpoons NO + SO_3$

	$SO_2$ (M)	$NO_2$ (M)	$NO$ (M)	$SO_3$ (M)
I	0.17	0.11	0	0
C	-x	-x	+x	+x
E	0.17 - x	0.11 - x	x	0.089

$K_{eq} = \frac{[NO][SO_3]}{[SO_2][NO_2]} = \frac{(0.089)(0.089)}{(0.081)(0.021)} = 4.7$

$1C_{(g)} + 1H_2O_{(g)} \rightleftharpoons 1H_2_{(g)} + 1CO_{(g)}$   
 $K_{eq} = \frac{[H_2][CO]}{[C][H_2O]}$

	$C$ (M)	$H_2O$ (M)	$H_2$ (M)	$CO$ (M)
I	2.25	0	0	0
C	-1x	+x	+x	+x
E	2.25 - x	x	x	x

$23.4 = \frac{x^2}{2.25 - x}$   
 $x^2 + 23.4x - 52.65 = 0$   
 $x = \frac{-23.4 \pm \sqrt{23.4^2 - 4(1)(-52.65)}}{2(1)}$   
 $x = 2.067$   
 $[H_2O] = 2.25 - x = 0.18 \text{ mol/L}$   
 $[H_2] = [CO] = x = 2.1 \text{ M}$

$x^2 - 4 = 0$   $x^2 - 4x + 4 = 0$   
 $x = 2$   $(x-2)(x-2) = 0$   
 $x^2 - 0.0005x - 4 = 0$   $x = 2$

$\frac{[I_2]}{K_{eq}} > 1000$